dresden elektronik

User Manual
Firmware Update

deRFusb-23E00
deRFusb-23E00 JTAG
deRFusb-23E06
deRFusb-23E06 JTAG
deRFusb-13E00
deRFusb-13E00 JTAG
deRFusb-13E06
deRFusb-13E06 JTAG

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Table of contents

1. Required Software 4

2. Software Installation 4

3. Preparations for update via USB 5
   3.1. Erase USB stick 5
   3.2. Driver Installation in Windows XP 7
   3.3. Driver Installation in Windows Vista and 7 12

4. Firmware update via USB (all operating systems) 17
   4.1. Connecting SAM-BA to the USB stick 17
   4.2. Transferring firmware 18

5. Firmware update via JTAG 20

6. Restoring the NV-memory 22

Document history

Date	Version	Description
2011-09-29	1.0	Initial version
2011-11-14	1.1	Added pictures for driver installation
2012-01-05	1.2	Updated to SAM-BA 2.11
2012-01-06	1.3	Updated driver installation

Author / Check / Release

	Firm	Division / Name
Author	DE	GBA / ELE / ML
Check	DE	ML
Release		

Overview

This Manual shows a way how to change the firmware on SAM3S based USB sticks from dresden elektronik. The update will be executed with the help of Atmel's® SAM-BA® (SAM Boot Assistant) program.

1. Required Software

- deRFsambaPatch (ZIP-file)
  http://www.dresden-elektronik.de

- For update via USB:
  SAM-BA 2.11 for Windows (XP, Vista, Seven editions);
  http://www.atmel.com/dyn/products/tools_card.asp?tool_id=3883

- Additionally for update via JTAG:
  SEGGER J-Link Software (If not already installed);
  http://www.segger.com/cms/jlink-software.html

2. Software Installation

At first you need to install SAM-BA 2.11 to a location of your choice (afterwards restart PC if necessary). If you have an earlier version of SAM-BA already on your computer, you may choose to install this as a second version, not uninstalling your old installation.

After SAM-BA 2.11 is installed, extract all the files of the deRFsambaPatch.zip into your SAM-BA installation directory so that SAM-BA can find the new applets and board descriptions. If you are prompted for an overwrite confirmation choose "Yes" to all files and directories.

Only for JTAG:

If not already installed, unzip and install SEGGR J-Link Software

Note: After applying the patch to your SAM-BA installation, only the new platforms deRFusbX3E00 and deRFusbX3E06 are available. All other platforms will be removed from the platform menu. To restore the previous platforms (and remove the deRFusb platforms) you must re-install SAM-BA. Alternatively you can also make a backup copy of the SAM-BA directory before applying the patch.

3. Preparations for update via USB

Two versions of the deRFusb sticks are available: one without, the other with preinstalled firmware. For USB sticks without preinstalled firmware the following step is not necessary since these USB sticks already have the SAM-BA interface activated.

3.1. Erase USB stick

For sticks with preinstalled firmware, either an appropriate update mechanism is provided or a JTAG interface is available. The JTAG interface offers the same functionality as described in section 4 and onwards. It is recommended to use dresden elektronik SAM-ICE Adapter to access the JTAG and Trace functionality with standard connectors.

You should only resort to the here described procedure, if you have absolutely no other choice since it deletes all data on the stick, including manufacturer supplied board data – e.g. the MAC address. Further explanations on this topic can be found in chapter 6.

Note: You should always include a software option into your own application firmware for activating the SAM-BA bootloader mode .Thus you are able to return to the SAM-BA interface of the SAM3 microcontroller. This can be achieved by changing the GPNVM1 bit. The erase procedure described below will always lead to a loss of important manufacture supplied data.

Attention: Without this software option, you have to use this procedure to update the firmware of the deRFusb sticks. All the manufacture supplied data will get lost.

To erase any firmware from the deRFusb stick you need to connect the stick to an USB port. While being powered, connect the two metal contacts on the bottom side of the printed circuit board (see figure below) for at least 1 second.

Attention: During the procedure all date stored in the flash of the USB stick including MAC address are deleted! For data recovery please refer to section 6.

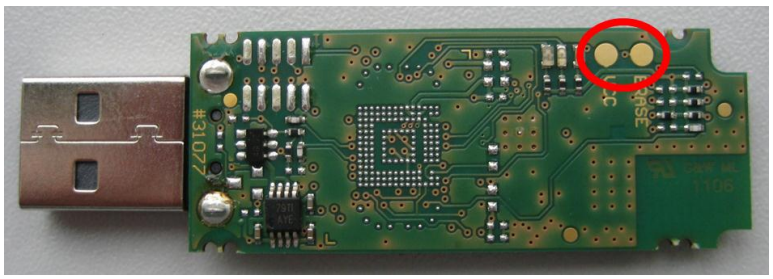

Figure 1: Bottom side deRFusb

Now the SAM-BA interface is activated. To start it, unplug the USB stick from the USB port and plug it in again. Your PC will prompt for a driver on Windows XP or will fail to find a suitable driver for Windows Vista and 7 editions. Depending on your operating system follow the steps described in section 3.2 (Windows XP) or 3.3 (Windows Vista and 7 editions).

Note: If your USB stick comes with a clear-sighted enclosure remove it carefully with an appropriate tool (e.g. a small screwdriver, see Figure 2).

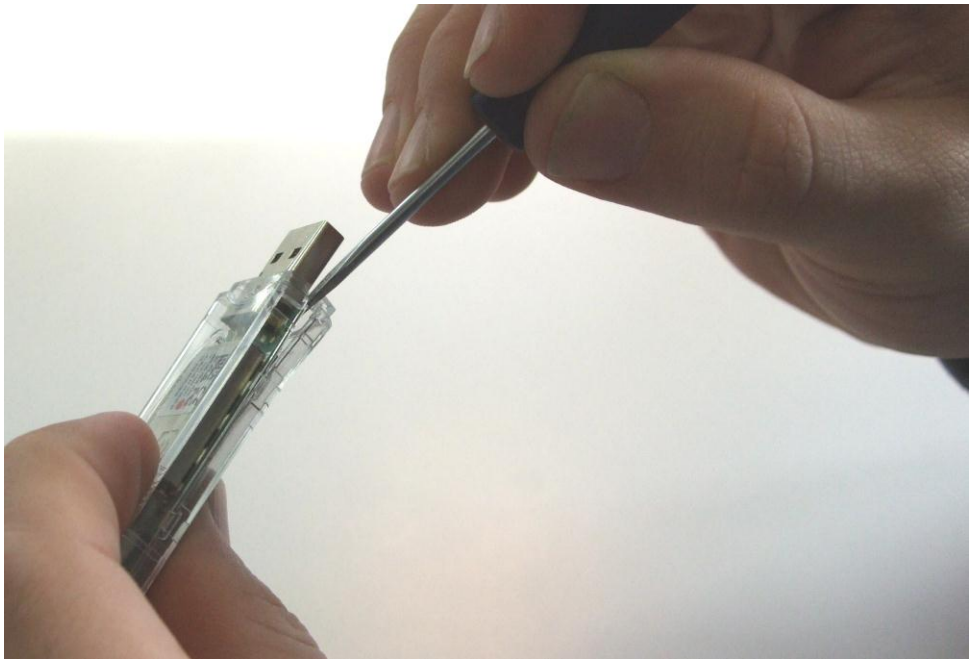

Figure 2: Removal of the plastic enclosure

3.2. Driver Installation in Windows XP

The first time you plug the USB stick in the “Found New Hardware Wizard” will pop up. Please select “No, not this time“ and press “Next”.

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

Figure 3: Found New Hardware Wizard

On the next screen choose “Install from a list or specific location (Advanced)” and press “Next”.

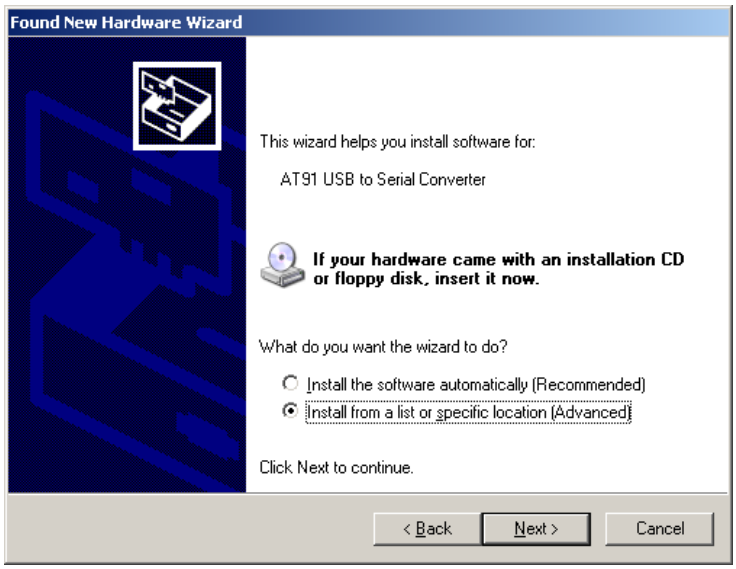
Found New Hardware Wizard
This wizard helps you install software for:
AT91 USB to Serial Converter
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

Figure 4: Install from a specific location

Select “Don’t search. I will choose the driver to install“ and press “Next”.

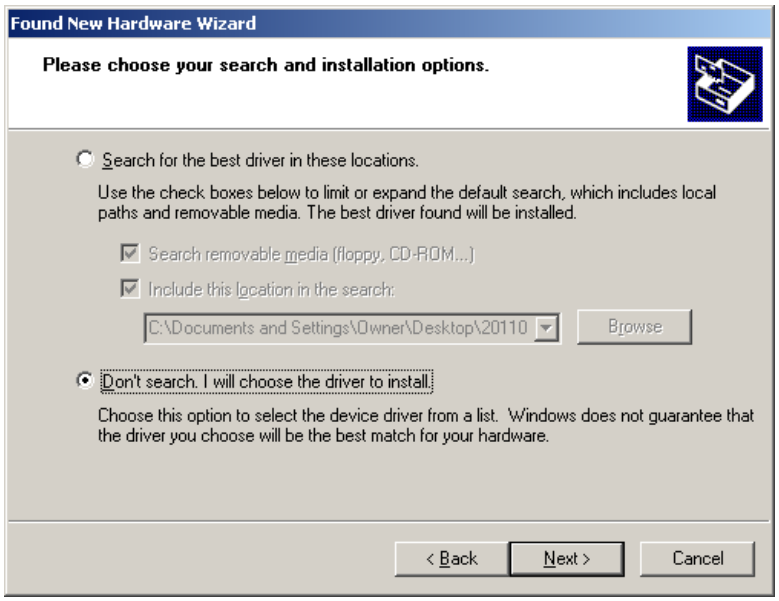
Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
C:\Documents and Settings\Owner\Desktop\20110
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

Figure 5: Choose driver manually

On the next dialog press the “Have Disk…“ button.

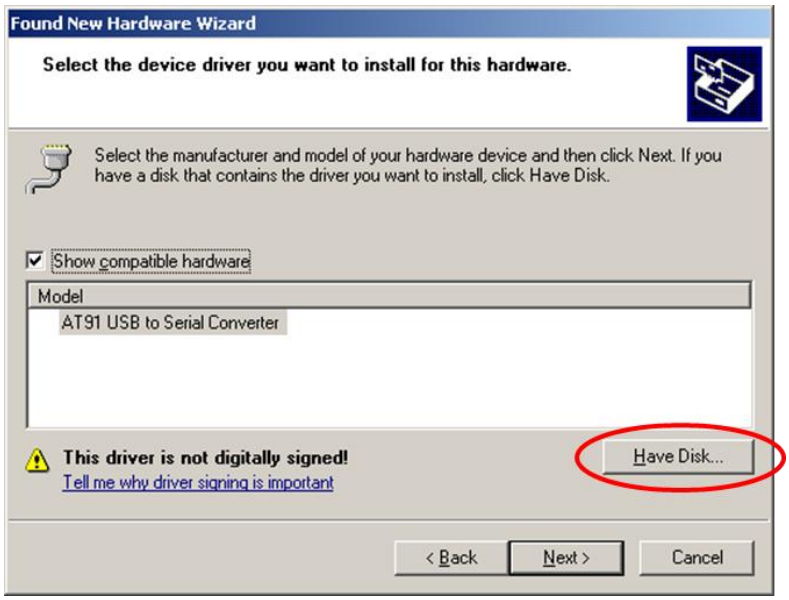
Found New Hardware Wizard
Select the device driver you want to install for this hardware.
Select the manufacturer and model of your hardware device and then click Next. If you have a disk that contains the driver you want to install, click Have Disk.
Show compatible hardware
Model
AT91 USB to Serial Converter
This driver is not digitally signed!
Tell me why driver signing is important
Have Disk...
< Back
Next >
Cancel

Figure 6: Select “Have Disk…”

Now click on “Browse…” and locate the directory of your SAM-BA installation; it can be usually found under “Program Files”. This installation directory contains a subdirectory “drv”. Please select and enter this directory.

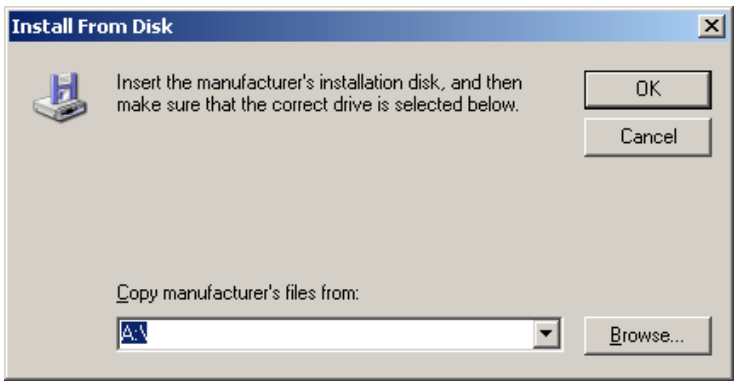

Figure 7: Choose location: Browse…

The file “atm6124_cdc” should pop up; select it and press the “Open” button.

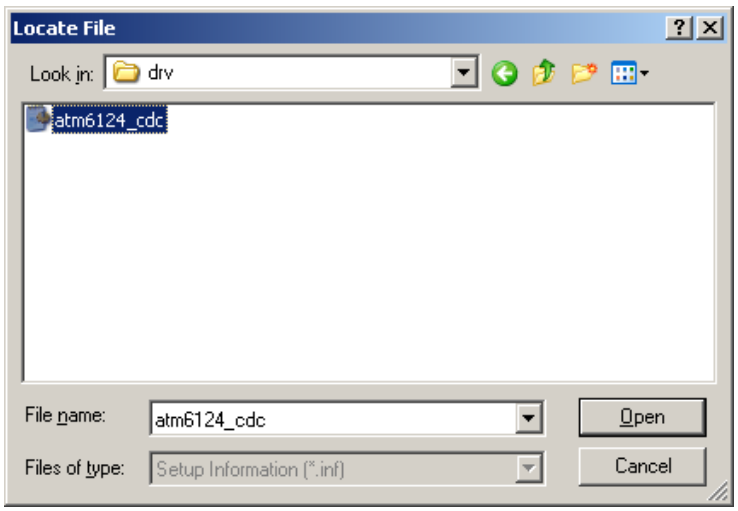

Figure 8: Locate File: atm6124_cdc.inf

By pressing “OK” now you will return again to the previous dialog:

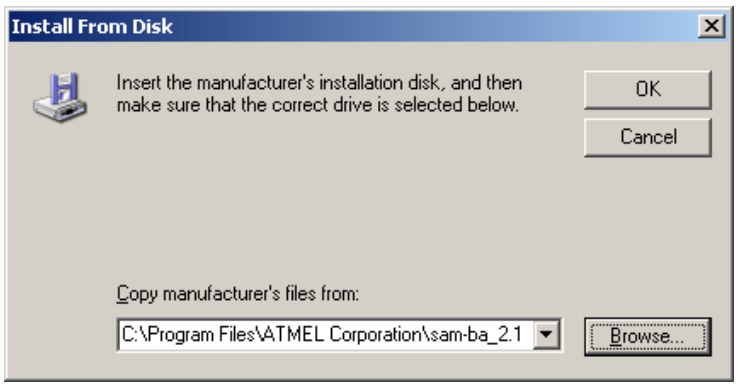
Install From Disk
Insert the manufacturer's installation disk, and then make sure that the correct drive is selected below.
OK
Cancel
Copy manufacturer's files from:
C:\Program Files\ATMEL Corporation\sam-ba_2.1
Browse...

Figure 9: Install from disk: Continue with “OK”

Now select the “AT91 USB to Serial Converter” and press “Next”. The driver will be installed.

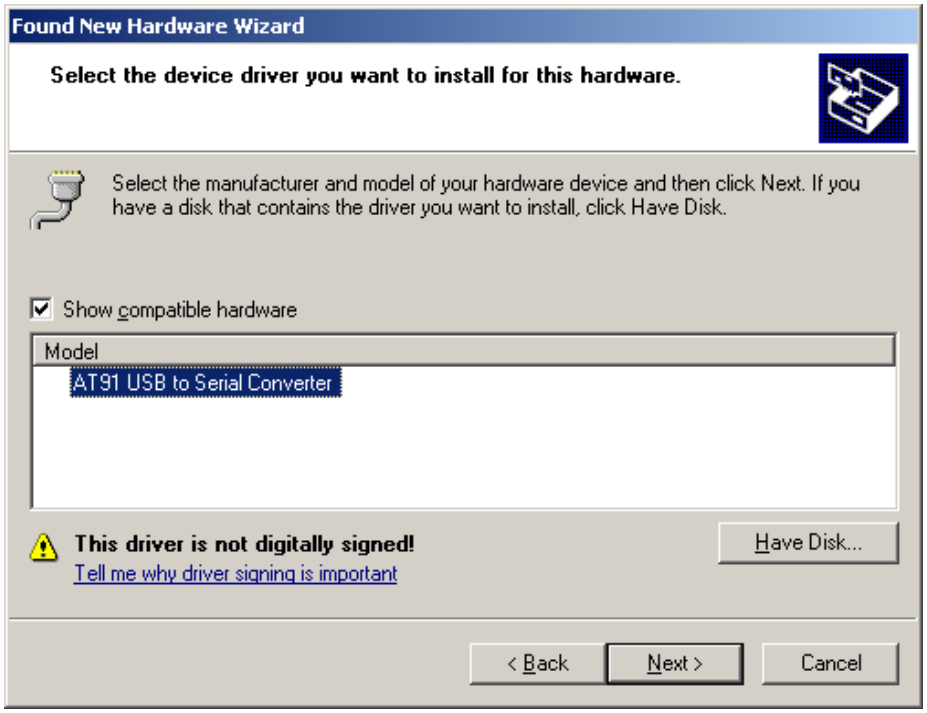
Found New Hardware Wizard
Select the device driver you want to install for this hardware.
Select the manufacturer and model of your hardware device and then click Next. If you have a disk that contains the driver you want to install, click Have Disk.
Show compatible hardware
Model
AT91 USB to Serial Converter
This driver is not digitally signed!
Tell me why driver signing is important
Have Disk...
< Back
Next >
Cancel

Figure 10: Continue with “Next >”

If a message box “Driver is not digitally signed” appears press “Continue anyway”. The wizard will finish the driver installation. Press “Finish” to close the wizard.

Found New Hardware Wizard
Completing the Found New Hardware Wizard
The wizard has finished installing the software for:
AT91 USB to Serial Converter
Click Finish to close the wizard.
< Back
Finish
Cancel

Figure 11: Finish the installation

After successful driver installation you will find the device under Ports (COM & LPT) in the device manager.

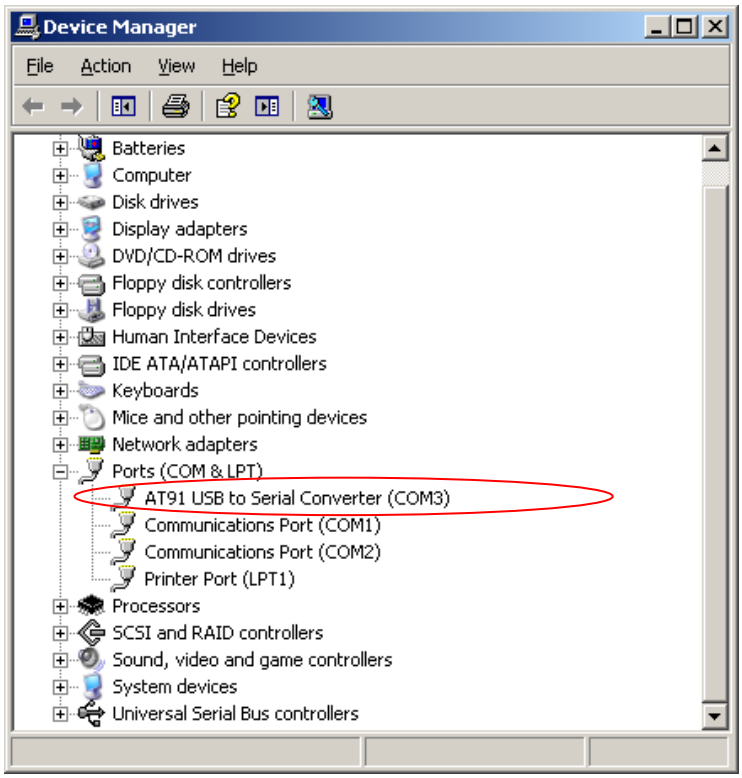

Figure 12: Successfully installed device

3.3. Driver Installation in Windows Vista and 7

If you plug in the USB stick for the first time, Windows will try to install any driver. This will usually fail and produces the following message:

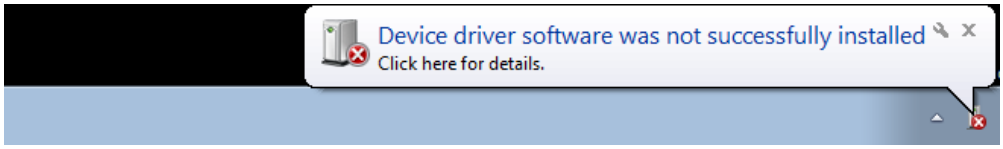

Figure 13: Driver not found in Win7 or Vista

To install the correct driver please open the Device Manager (which can be found under Control Panel > System > Device Manager). Here you will find an “Unknown device” in “Other devices”.

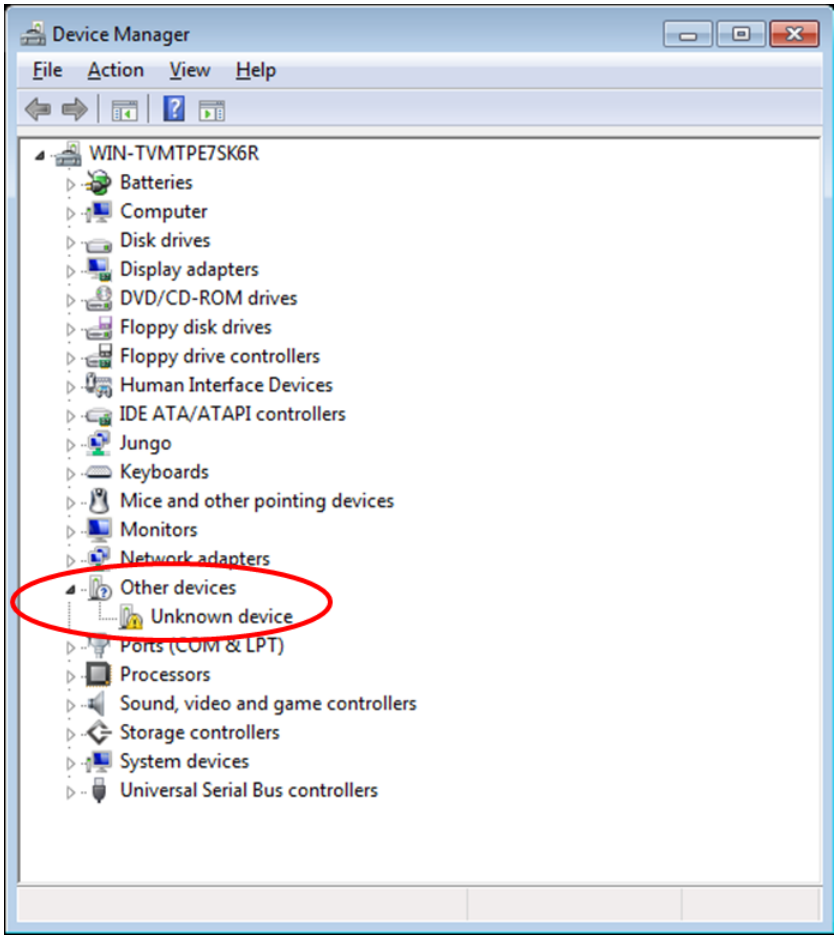

Figure 14: Driver not found in Device Manager

Select the “Unknown device”; open the context menu with a right mouse click. Select “Update Driver Software” in the menu.

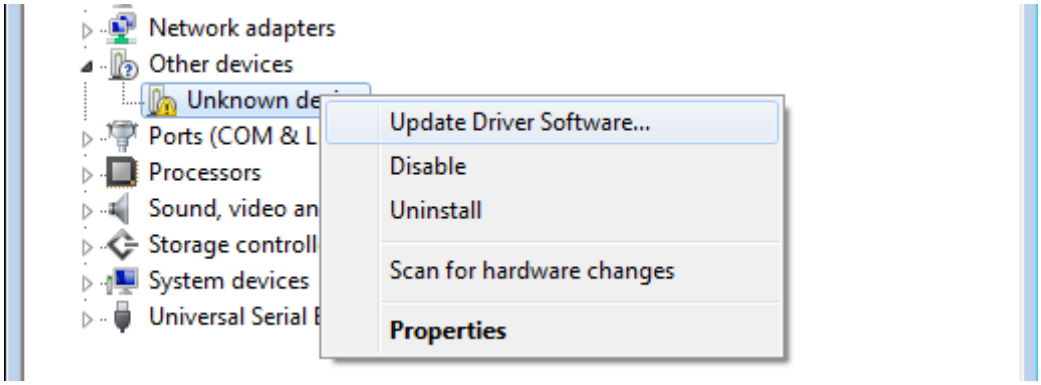

Figure 15: Update Driver Software…

Now choose “Browse my computer for driver software“ on the next dialog.

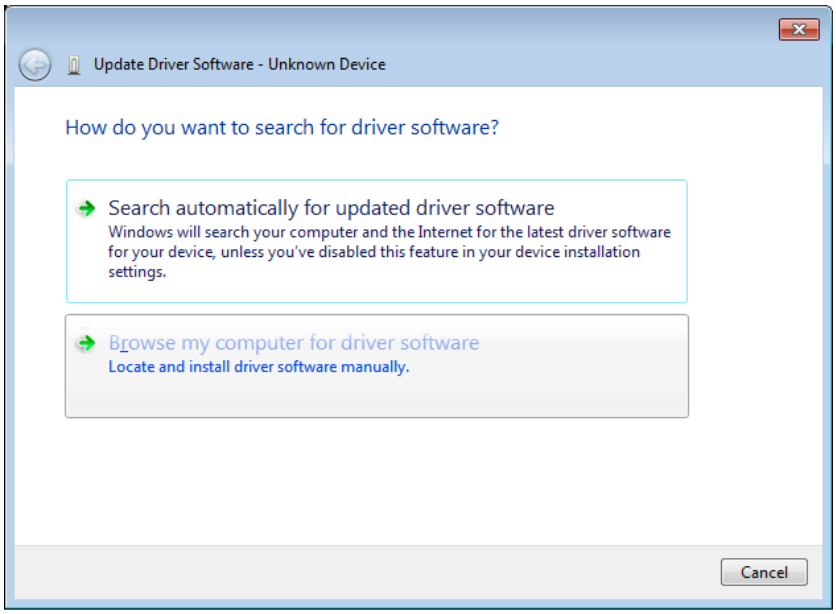
Update Driver Software - Unknown Device
How do you want to search for driver software?
Search automatically for updated driver software
Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.
Browse my computer for driver software
Locate and install driver software manually.
Cancel

Figure 16: Browse computer for driver software

Now click “Browse…” and locate the directory of your SAM-BA installation; it can be usually found under “Program Files”. This installation directory contains a sub-directory “drv”.

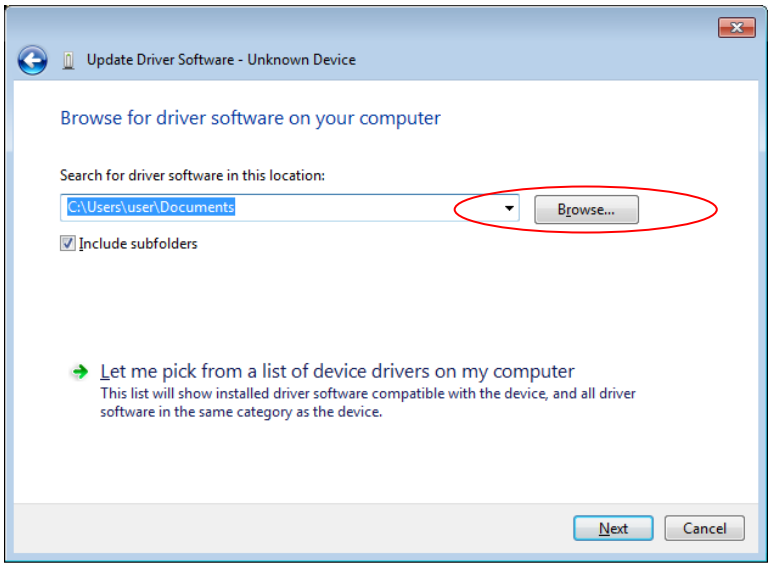
Update Driver Software - Unknown Device
Browse for driver software on your computer
Search for driver software in this location:
C:\Users\user\Documents
Browse...
Include subfolders
Let me pick from a list of device drivers on my computer
This list will show installed driver software compatible with the device, and all driver software in the same category as the device.
Next
Cancel

Figure 17: Browse…

Select this directory and press “OK”. This will return to the previous dialog.

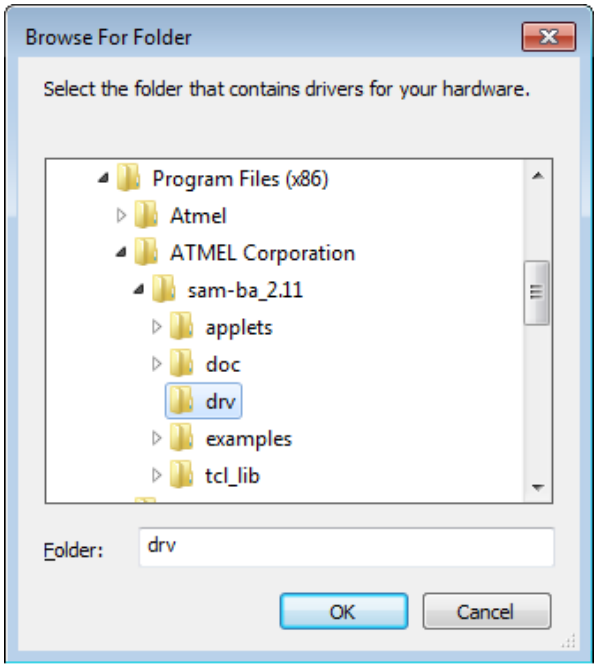

Figure 18: Browse For Folder: \drv

In the following dialog press “Next” to start the installation.

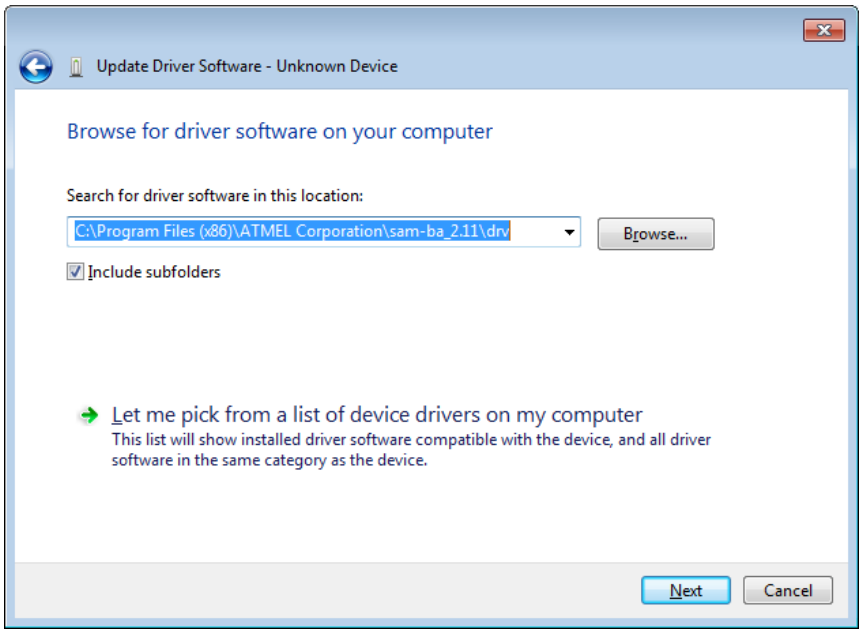
Update Driver Software - Unknown Device
Browse for driver software on your computer
Search for driver software in this location:
C:\Program Files (x86)\ATMEL Corporation\sam-ba_2.11\drv
Browse...
Include subfolders
Let me pick from a list of device drivers on my computer
This list will show installed driver software compatible with the device, and all driver software in the same category as the device.
Next
Cancel

Figure 19: Continue with “Next”

If a Windows Security message pops up choose “Install this driver software anyway”.

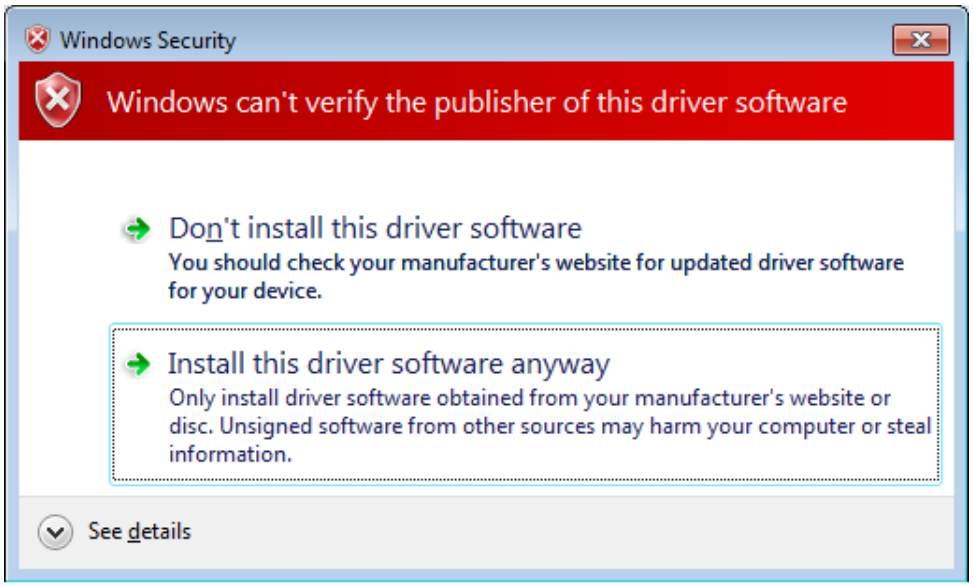
Windows Security
Windows can't verify the publisher of this driver software
Don't install this driver software
You should check your manufacturer's website for updated driver software for your device.
Install this driver software anyway
Only install driver software obtained from your manufacturer's website or disc. Unsigned software from other sources may harm your computer or steal information.
See details

Figure 20: Choose “Install this driver software anyway”

You will see the installation progress. Close the wizard after the installation is finished by pressing “Close”.

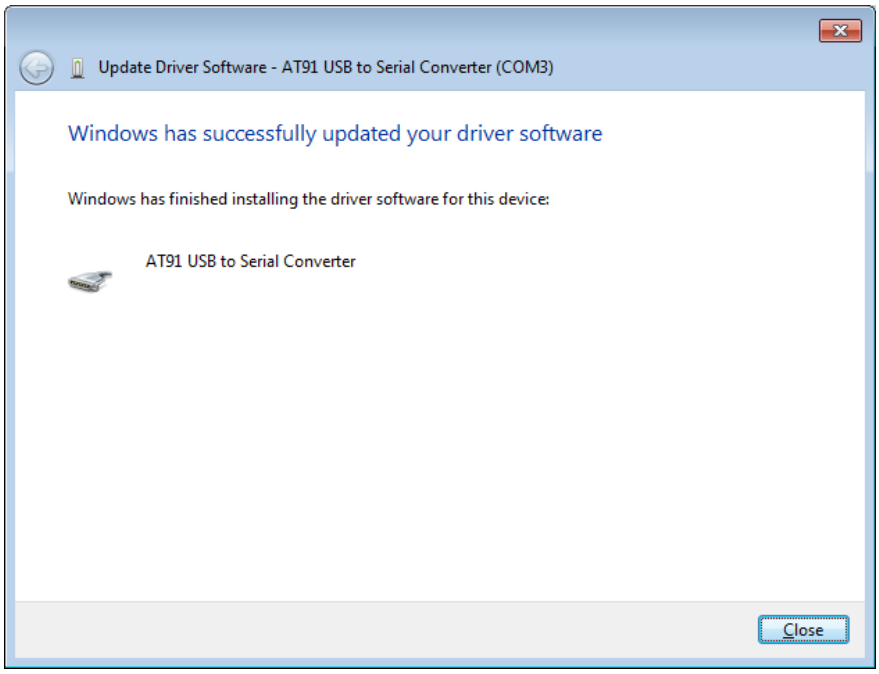
Update Driver Software - AT91 USB to Serial Converter (COM3)
Windows has successfully updated your driver software
Windows has finished installing the driver software for this device:
AT91 USB to Serial Converter
Close

Figure 21: Successful installation of the driver

After a successful driver installation you will find an “AT91 USB to Serial Converter” in the Device Manager under the ports (COM & LPT):

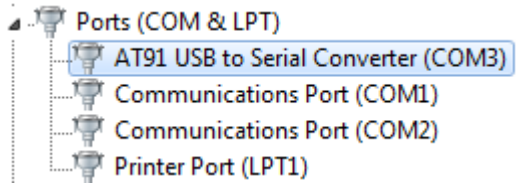

Figure 22: Device displayed in the device manager

4. Firmware update via USB (all operating systems)

The steps to update the firmware are equal for all Windows XP, Vista and 7 Editions.

4.1. Connecting SAM-BA to the USB stick

Start your SAM-BA v2.11. The short-cut may be found either on the desktop or in the start menu (depending on your installation).

SAM-BA scans your COM ports and presents a selection dialog for the connection and the platform.

Select the COM port for the deRFusb stick to update. You will find it in the Device Manager as described in the previous sections. As a second step, select the platform which will be either deRFusbX3E00 or deRFusbX3E06.

Note: If you cannot select these platforms, you should reinstall the deRFsamba patch following the instructions in section 2 closely.

Press “Connect” with connection and platform selected:

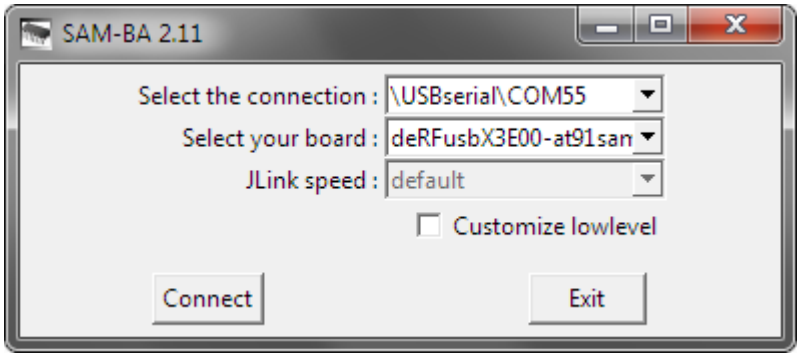

Figure 23: Connect to the deRFusb

SAM-BA now tries to connect to the USB stick. This can take some seconds. Finally a dialog window opens giving access to all the memories of the microcontroller.

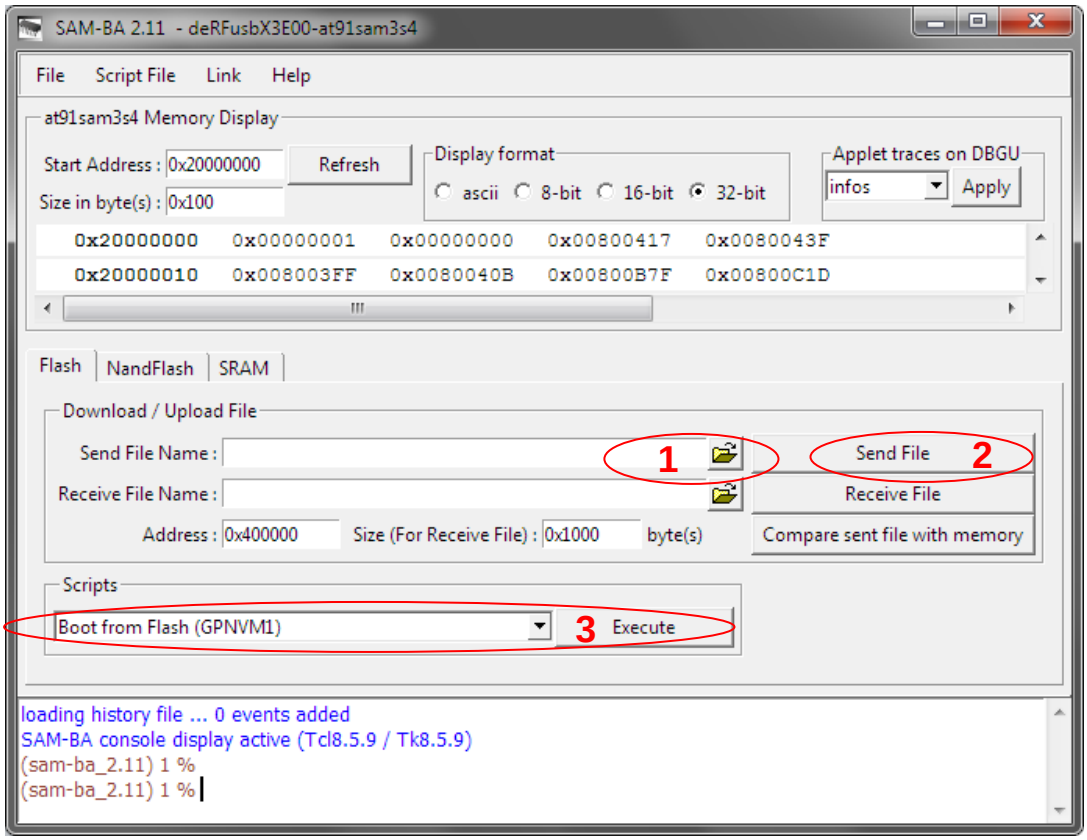

Figure 24: SAM-BA GUI

4.2. Transferring firmware

To transfer a new firmware to the USB stick you have to to select the binary at first. This file must be in binary format. No other formats will be accepted. To select a binary new firmware file press the button marked with **(1).** A file dialog will pop up and lets you locate and select the file to upload. After you selected the file press “Send File” **(2)**. Your file will be transferred. At the end SAM-BA will ask you if you want to lock the flash. This is not necessary; you can omit it by pressing “No”:

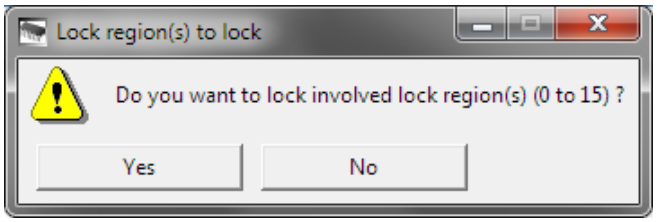

Figure 25: Lock regions

One final step needs to be executed. Your deRFusb stick is still in SAM-BA mode and you need to change the Boot Mode to let the USB stick start your firmware. This can be achieved by executing a script from the Scripts drop-down box.

To select the correct script open the drop-down box **(3)** and select the entry “Boot from Flash (GPNVM1)”. Execute the script by pressing “Execute” **(3)**.

Now the update is finished. Close SAM-BA and unplug the USB stick. The next time you connect the USB stick to a USB port your just uploaded firmware will be executed.

5. Firmware update via JTAG[1]

As an alternative the update procedure may be done via the JTAG-interface (if assembled) of the USB stick. Moreover a SAM-ICE adapter is required to connect the USB-stick to the JTAG-Interface. The following image shows how the assembly is done:

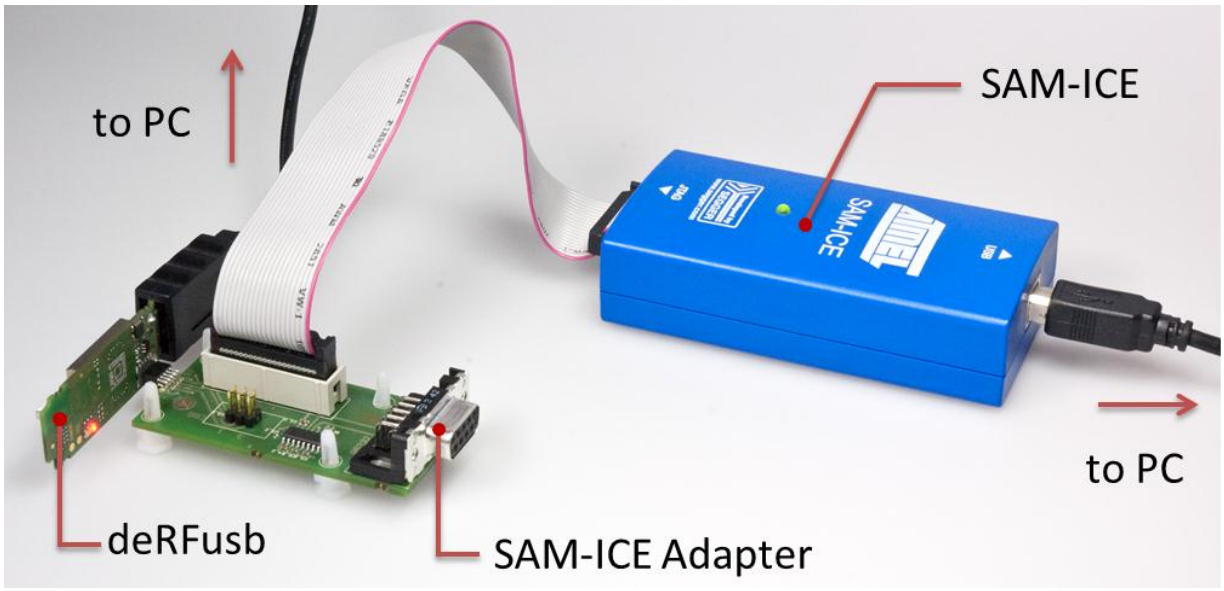

Figure 26: USB dongle with attached SAM-ICE and SAM-ICE Adapter

To update the dongle with the attached JTAG interface the required software has to be installed like explained in chapter 2.

The figure below shows the hardware assembly schematically.

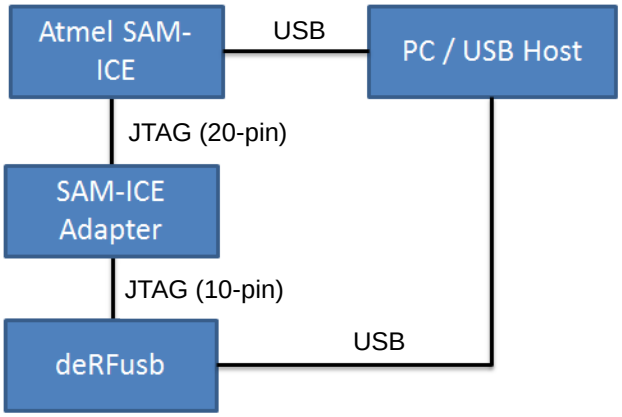

Figure 27: Hardware setup schematic

[1] This option can currently only be used if no Firmware is installed on the USB-Stick; e.g. if an ERASE has been executed before (see 3.1). (Update in preparation)

Start SAM-BA v2.11 to execute the update procedure. Select \jlink\ARM0 under “Select the connection” and choose an appropriate board.

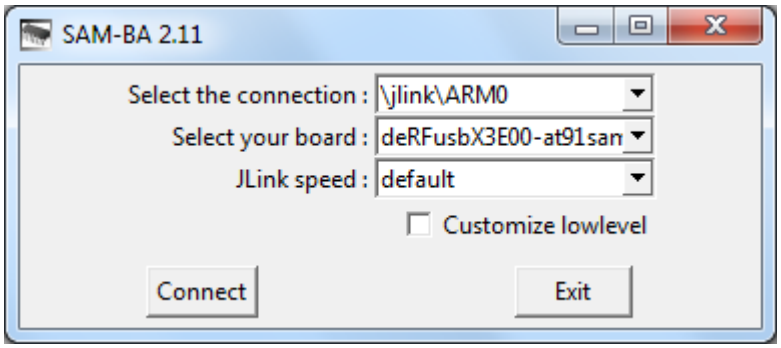

Figure 28: Choose board and connection

Thereafter the connection can be established using the “Connect” button. The transfer of the firmware is analog to chapter 4.2.

6. Restoring the NV-memory

If the flash memory of the USB dongle is erased the MAC address which is stored there will be lost. This address is required for the BSP-examples as well as for the identification of the RF node. If the user wants to use BSP-examples he or she has to restore this address in case it has been erased.

The MAC address is printed on the label which is adhesive to the RF shielding of the USB dongle:

Figure 29: MAC address (marked red)

The memory area for storing the MAC address is organized as follows:

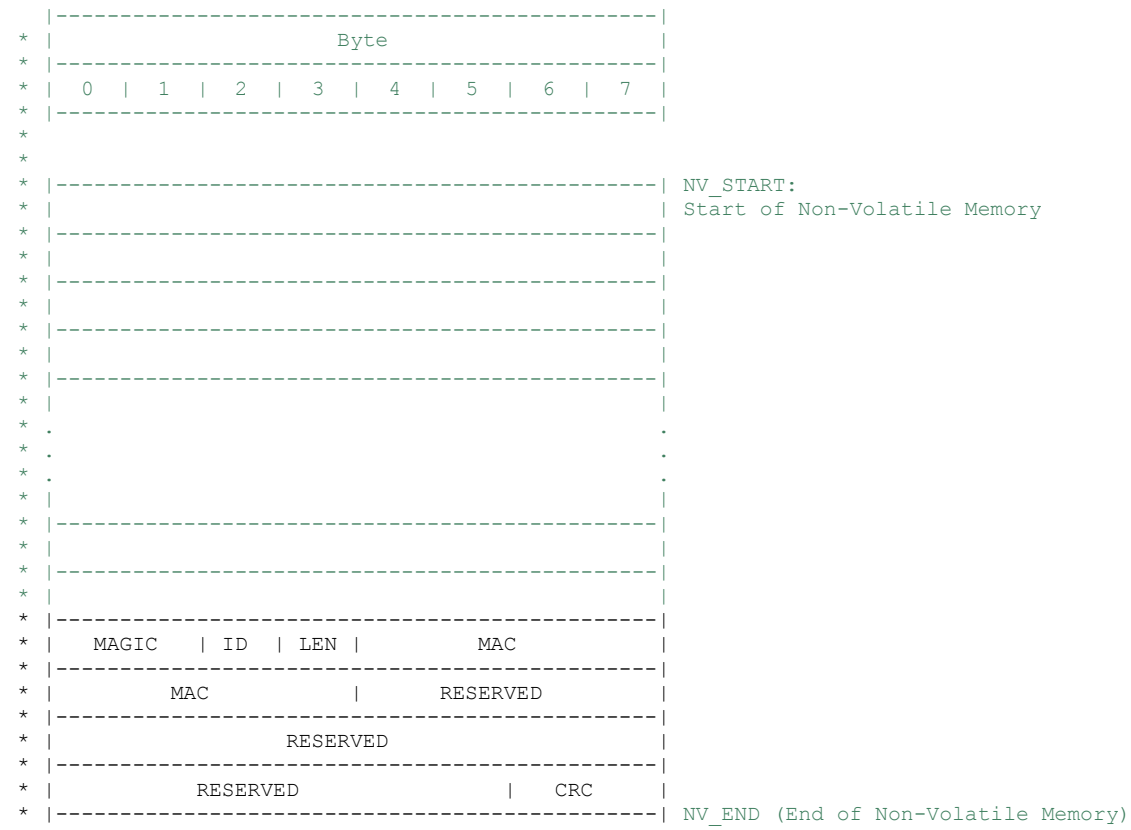
Byte
0 | 1 | 2 | 3 | 4 | 5 | 6 | 7
NV_START:
Start of Non-Volatile Memory
MAGIC | ID | LEN | MAC
MAC | RESERVED
RESERVED
RESERVED | CRC
NV_END (End of Non-Volatile Memory)

Figure 30: Structure holding the MAC address

For memory saving reasons the structure is located in the upper memory stack of the controller's flash memory. The USB dongle uses a MCU which comes with flash capacity of 256 kB organized in 1024 pages. The start address of the program flash is 0x400000 while the end address is 0x43FFFF. Figure 30 shows the end address as NV_END. The absolute address value is 0x43FFFF and is the last byte of the CRC sum field. The structure covers 32 bytes and is distributed on the addresses 0x43FFE0... 0x43FFFF.

The values for MAGIC, ID and LEN are:

MAGIC:	0xDE90
ID:	0x01
LEN:	8

The CRC is calculated over all data bytes. In this case these are the fields MAGIC, ID, LEN and MAC (12 bytes). For calculation and checking it is recommend using the following function:

```
static uint16_t calc_crc(uint8_t* pBuffer, uint8_t size)
{
   uint8_t tmp;
   uint8_t high, low;

   high = 0xFF;
   low = 0xFF;

   while (size > 0)
   {
      tmp = *pBuffer;

      high = high ^ tmp;
      high = high ^ ((high >> 4) & 0x0F);
      tmp = high >> 3;
      low = low ^ (tmp & 0x1F );
      low = low ^ ((tmp >> 1) & 0x0F);
      tmp = (tmp & 0x0E) ^ high;
      high = low;
      low = tmp;

      pBuffer++;
      size--;
   }

   size = high;
   size = (size << 8) + low;

   return size;
}
```

The above described information and the corresponding source code can also be found in the source code of deMAC:

```
\BSP\Generic\nv_basic.c
\BSP\Generic\nv_basic.h
```

For creating the structure (also called basic set) it is recommend using the following structure:

```
typedef struct
{
   uint16_t magic;
   uint8_t  id;
   uint8_t  length;
   uint8_t  mac[8];
   uint8_t  reserved[18];
   uint16_t crc;
}__attribute__((packed)) basic_set_t;
```

For recovering the mac address the user has to create a firmware allowing a mac address input via console. Alternatively the string input can be omitted. Therefore the address has to be known at compile time and thus be specified in the source code.

Though important is that upon updating the firmware in any way the memory area that holds the mac address structure must not be changed or erased. Erasing the memory like explained in chapter 3.1 is no option.

It is also possible to incorporate the creation of the MAC structure into the user specific firmware. In this way the persistence of the MAC can be easily achieved; even if an update procedure with SAM-BA is executed.

The following approach is recommended to recover the MAC address including the structure explained above:

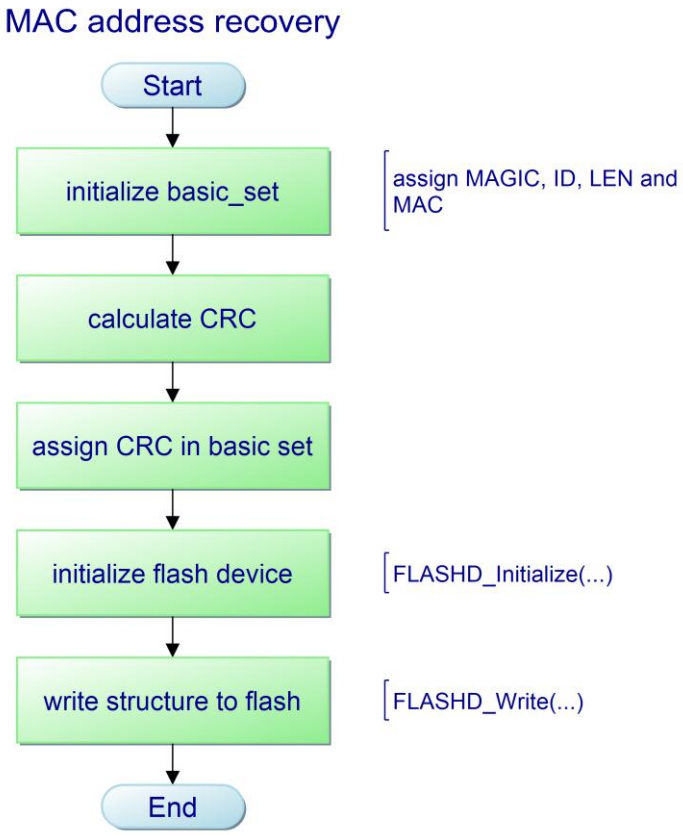

Figure 31: Approach for MAC address recovery

Please refer to the AT91-Lib-code, too. The functions mentioned above `FLASHD_Write(...)` and `FLASHD_Initialize(...)` enable in system programming of the flash memory.

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